EJVES Extra **6**, 54–58 (2003)
doi: 10.1016/S1533-3167(03)00081-5, available online at http://www.sciencedirect.com on SCIENCE DIRECT®

SHORT REPORT

Temporary Arterial and Venous Bypass for Resection of Retroperitoneal Sarcomas

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Retroperitoneal sarcomas that simultaneously affect large abdominal vessels are rare. Tumour resection and vascular clamping may take a long-time, and possibly have significant local and systemic consequences. For this reason, temporary arterial and venous bypass may be useful. Three patients underwent operation with utilization of this technique, which made it possible to resect tumour masses with a shorter duration of ischaemia, while maintaining venous return. These patients remain free of disease after an average follow-up of 37 months, without any arterial graft complications. Two of the patients progressed to symptomatic occlusion of the venous graft after the perioperative period.

Key Words: Retroperitoneal sarcoma; Temporary bypass; Vascular reconstruction.

Retroperitoneal sarcomas are rare tumours that comprise up to 15% of all soft tissue sarcomas. They are characterized by the absence of specific symptoms, which is why their diagnosis is delayed and becomes possible only when they are large and bulky.

Surgical resection is the main form of treatment of retroperitoneal sarcomas,[1] since characteristically they do not respond to radiotherapy or chemotherapy. In rare cases, in order to achieve complete *en bloc* resection, tumour removal with replacement of the large abdominal vessels is required. In such cases the length of vascular cross-clamping time is unpredictable, and may be associated with significant local and systemic consequences.

In these cases, the utilization of temporary arterial and venous vascular bypass may be useful, since there will be shorter duration of ischaemia and venous return will be maintained during the tumour resection.

We report on the use of a new type of temporary bypass during the resection of retroperitoneal sarcomas involving the major abdominal vessels.

Methods

Three patients with retroperitoneal sarcomas were referred by the oncology department for evaluation by the vascular surgeon because of suspected involvement of the large abdominal vessels. These suspicions were based on findings from radiological examinations, since the physical vascular examination was normal. Computerized tomography showed that the vascular bundles were surrounded by tumour masses (Fig. 1(a)–(c)). Surgical access in all cases was by median xiphoid-pubic laparotomy. After identification and partial dissection of the masses, invasion of the large abdominal vessels was confirmed.

Dissection and control of the proximal vessels was done intra-abdominally and distally in the inguinal regions, since the external iliac vessels were inaccessible because of the large extent of the tumours.

The temporary bypass consisted of knitted Dacron prostheses, using their original length to facilitate their handling during resection of the tumour without traction on the anastomosis (Fig. 2(a) and (b)). In one case, a bifurcated 18×9 mm prosthesis was used. End-to-side proximal arterial anastomoses were performed, with ligatures distal to the anastomosis to diminish the arterial flow to the tumour mass. The distal arterial anastomoses were also done end-to-side, with ligatures proximal to these anastomoses to diminish the intra-abdominal arterial reflux. The venous anastomoses and subsequent ligatures were similar to the arterial ones. The anastomoses were

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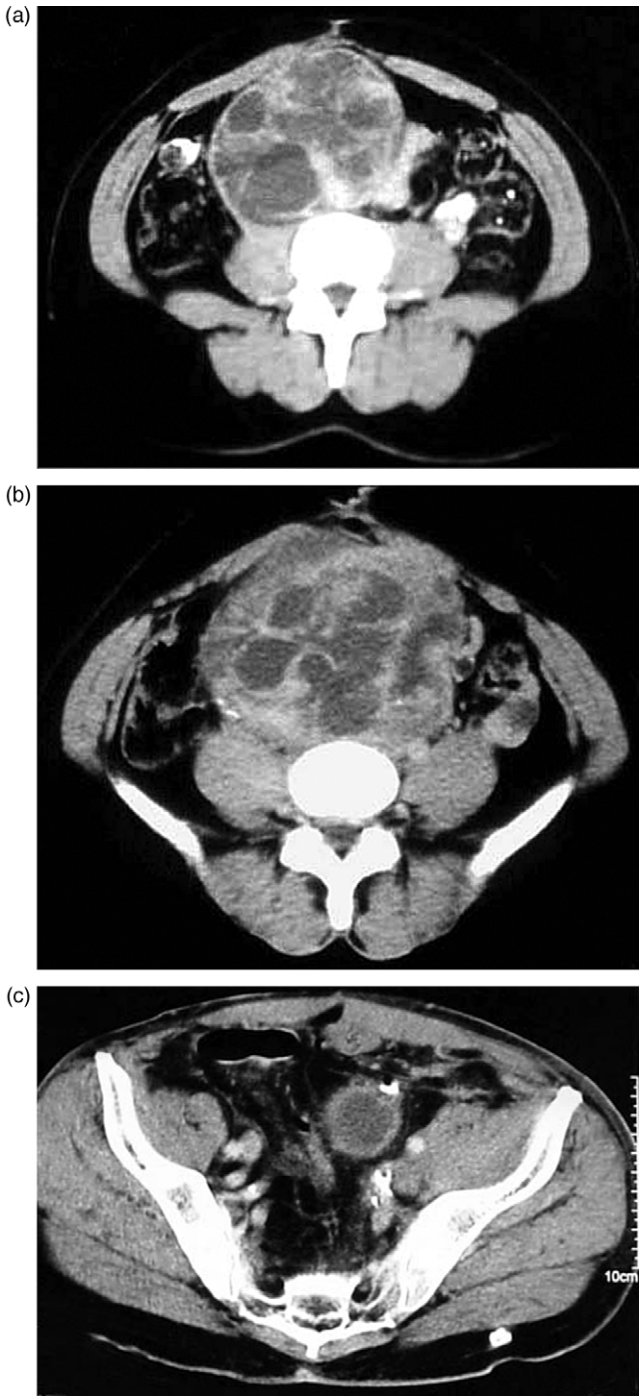

Fig. 1. (a) Computerized tomography showing the aorta and vena cava affected by the tumour (case 1). (b) and (c) Computerized tomography showing iliac vessels affected by the tumour (cases 1 and 3).

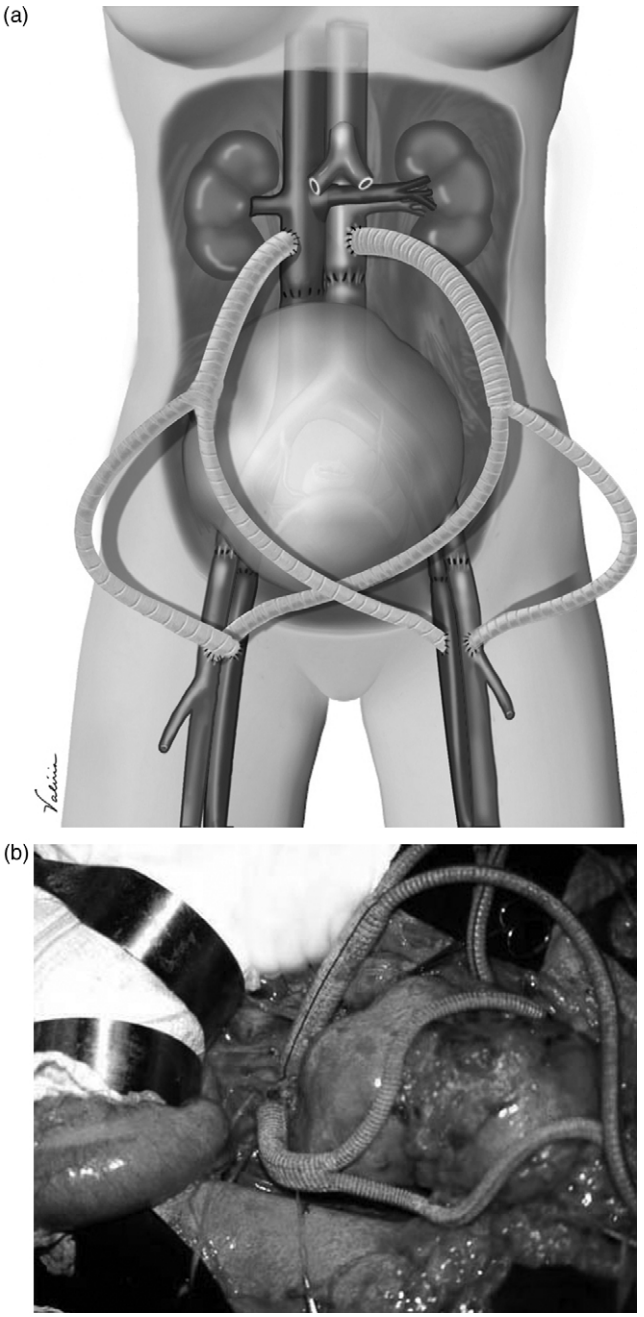

Fig. 2. (a) Illustration showing the temporary bypass of patient 1: aortobifemoral and common femoral veins to vena cava. (b) Intraoperative view.

end-to-side because this was technically easier and also required less extensive dissection, especially in the intra-abdominal region.

These procedures were performed under intravenous anticoagulation with 5000 units of heparin which was reversed using protamine sulfate. After complete resection of the masses, which took 120 min on average, the patient was given 5000 units of heparin so that the redundant portions of the arterial and venous grafts could be shortened, thus transforming the temporary bypass into a permanent one (Fig. 3(a) and (b)).

Results

Complete resection of the sarcoma was accomplished in all three patients. There were no adverse events during the perioperative period.

The clinical summaries for the three patients are displayed in Table 1.

The patients were followed up on an outpatient basis, with physical examination and duplex mapping performed for evaluating the grafts. The duplex mapping was done every six months over the first two years and annually thereafter or whenever there was suspicion of graft occlusion.

The arterial grafts were found to be functioning without stenosis or dilatation. Two patients (1 and 2) progressed to pain and oedema in the lower limbs after 40 days and 10 months. Duplex mapping confirmed occlusion of the venous grafts and the patients were treated using systemic anticoagulation and elastic support. The second patient still has moderate oedema of the lower limb.

The patients are alive without signs of disease recurrence after 52, 56 and 4 months of follow-up.

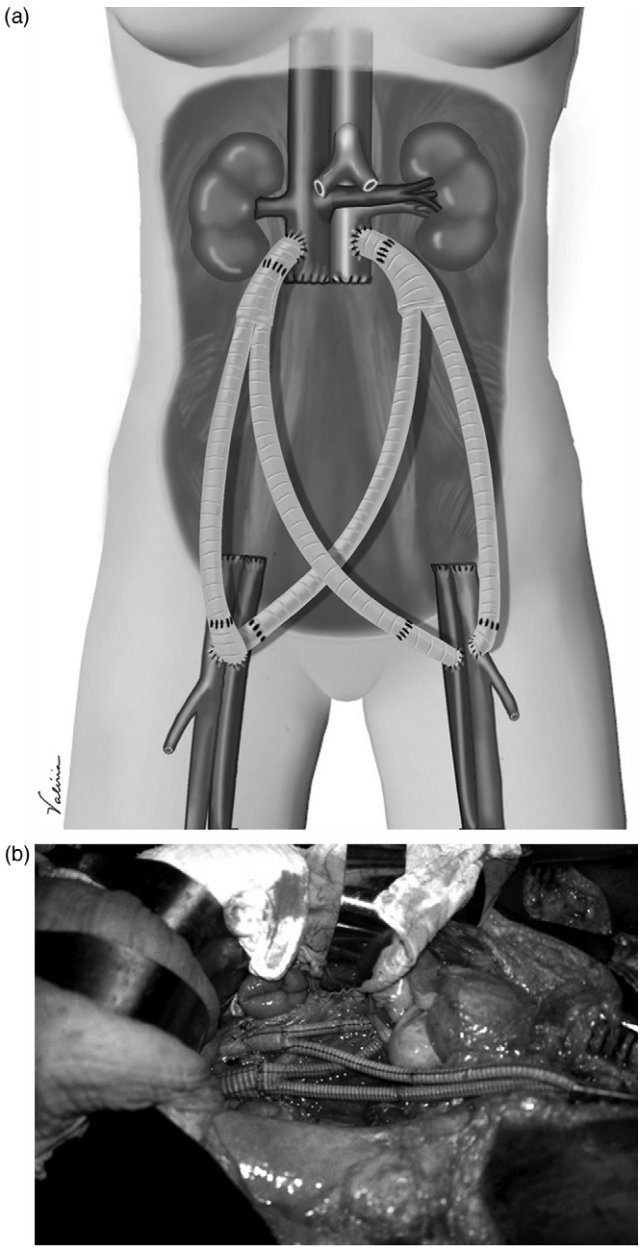

Fig. 3. (a) Illustration showing the final appearance of the bypass. (b) Intraoperative view.

Discussion

The most important factor in determining the prognosis for patients with retroperitoneal sarcomas is the complete resection of the tumour in the initial approach. For patients undergoing complete resection, the five-year survival is on the order of 60%.[1] For patients undergoing incomplete resection or those with tumours that cannot be resected, the survival rates are inferior and a large proportion of such patients progress to death in the initial years following surgery.

The rates of unresectable retroperitoneal sarcomas range between 22 and 62%[1,2] and the main causes are: involvement of the large vessels (43%), peritoneal implants (28%), distant metastases (19%), tumour involvement of the base of the mesentery (8%) and invasion of the spinal medulla (6%).[2]

Reconstruction of the large abdominal vessels concomitant to neoplasm resection is not often done,[3] because normally such patients are at an advanced stage of the disease and have a very poor prognosis and high surgical risk.[4]

The indication for arterial reconstruction in our cases was unquestionable, since arterial ligature would probably have induced severe ischaemia in lower limbs, with intense local and systemic impacts.[5]

In the first case, we knew of the risk of intestinal ischaemia[6] due to the extensive ligation of the infrarenal vessels, including the hypogastric arteries. Nonetheless, the patient was technically not in a suitable state for revascularization of the intra-abdominal stumps.

Venous reconstruction is not always performed, because usually the ligature does not interfere with the preservation of the limb[7] and patency rates are not very satisfactory, even when a distal arterial-venous fistula is performed and oral anticoagulants are administered.[8,9] But in our cases, in addition to the veins, a large part of the collateral venous circulation

Table 1.

P	S/A	Resected vessels	Arterial graft	Venous graft	TRD (m)	Intraoperative transfusion (PRC/FP)	Vascular complication
1	F/29	Infrarenal aorta and cava, bilateral iliac	Infrarenal aorta-common bifemoral	Common bifemoral-infrarenal cava	140	8 U/4 U	Venous occlusion
2	M/52	Iliac bifurcation and external iliac	Common iliac-common femoral	Common femoral-common iliac	120	5 U/5 U	Venous occlusion
3	M/54	External iliac	Common iliac-common femoral	Common femoral-common iliac	130	7 U/6 U	–

P, patient; S, sex; A, age; TRD, tumor resection duration; m, minutes; PRC, packed red cells; FP, fresh plasma; U, unit.

was to be resected, favouring the onset of acute[7] and chronic venous hypertension[10] in the lower limbs.

The utilization of Dacron prostheses[11] for the arterial graft was justified by the long experience gained in reconstructing the aorto-iliac region and the high rate of long-term patency obtained. Prostheses[12] are also normally used in the iliac-cava region and those with external support have the theoretical advantage of being better able to withstand extrinsic compression, although no comparative study between prostheses with and without external support is yet available for this region. One autologous substitute would be the femoral vein,[13] although this would have the disadvantages of slow harvesting and late-stage morbidity in the donor limb.

We selected Dacron prostheses because of their greater flexibility in relation to PTFE, thereby permitting mobility with ample ease needed in these cases.

In the cases described, four techniques for further tumour resection would be possible: tumour resection with sub-adventitial dissection of the vessels; extra-anatomical grafts followed by tumour resection; tumour resection followed by anatomical grafts; and temporary grafts followed by tumour resection and definitive revascularization.

Tumour resection with sub-adventitial dissection could have been attempted. However, the vessels were found to be surrounded by tumour, thus making this an intra-tumoural procedure and therefore precluding curative resection.

Extra-anatomical grafts such as axillobifemoral or crossed femorofemoral procedures are normally performed in patients with high surgical risk or adverse abdominal conditions. However, we would then have had to deal with the need to utilize off-axis vessels, with additional morbidity and reduced long-term patency.[14,15]

Tumour resection followed by anatomical grafts requires a very long cross-clamping time, as observed in our cases. This could cause ischaemia in the large muscle masses of the lower limbs, with potentially severe consequences.[3,5] Prolonged venous clamping accompanied by resection of the collateral vessels could cause have increased retroperitoneal bleeding, and reduced effective circulating volume and severe muscle oedema.

Temporary shunts are classically utilized in selected cases of carotid endarterectomy[16] and vascular trauma,[17] with the objective of maintaining normal blood flow until the completion of the definitive vascular reconstruction. In the cases presented, the utilization of a temporary bypass along the anatomical pathway made it possible to resect the sarcoma without the risks of prolonged clamping and, afterwards,

to effect the definitive grafting via the simple resection of the redundant portions of the prostheses.

Even though there was symptomatic occlusion of the venous grafts, this only occurred after the perioperative period.

We have described a technique using temporary arterial and venous bypass for resecting retroperitoneal sarcomas associated with reconstruction of the large abdominal vessels, with positive functional and oncological results.

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Accepted 14 October 2003